

WCLF 77

★ NORTH STAR COMPUTERS, INC.





The following pages give expanded descriptions of currently available North Star products. For more information about a particular product, a documentation packet may be purchased. Documentation packets include all hardware and software documentation distributed with the product. Our current price schedule is as follows:

|                                            |        |
|--------------------------------------------|--------|
| MICRO-DISK SYSTEM (MDS-A-KIT)              | \$699  |
| MICRO-DISK SYSTEM (MDS-A-ASM)              | \$799  |
| ADDITIONAL DRIVE (MDS-DRIVE-KIT)           | \$425  |
| ADDITIONAL DRIVE (MDS-DRIVE-ASM)           | \$450  |
| SINGLE-DRIVE CABINET (MDS-CAB)             | \$ 39  |
| SINGLE-DRIVE POWER SUPPLY (MDS-PS)         | \$ 39  |
| ADDITIONAL DISKETTE (MDS-DISKETTE)         | \$4.50 |
| MDS SPECIAL VERSION* (MDS-SPEC)            | \$ 25  |
| MDS DOCUMENTATION PACK (MDS-A-DOC)         | \$ 10  |
| MODEL A FLOATING POINT BOARD (FPB-A-KIT)   | \$359  |
| MODEL A FLOATING POINT BOARD (FPB-A-ASM)   | \$499  |
| MODEL A FPB DOCUMENTATION PACK (FPB-A-DOC) | \$ 10  |
| MODEL B FLOATING POINT BOARD (FPB-B-KIT)   | \$359  |
| MODEL B FLOATING POINT BOARD (FPB-B-ASM)   | \$499  |
| MODEL B FPB DOCUMENTATION PACK (FPB-B-DOC) | \$ 10  |

North Star products include a limited warranty of 90 days for kits and 180 days for assembled units. U.S. Shipping (within contiguous 48 states) is included with fully prepaid orders. To place orders, please send check or money order for full amount. Uncertified checks require up to 6 weeks processing. BankAmericard and Master Charge orders are also accepted. California residents please add sales tax. Prices are subject to change without notice.

Delivery is stock to 60 days.

\*To place an order for a non-standard version of the MICRO-DISK SYSTEM, first request the "MDS SPECIAL ORDER BLANK."

### NORTH STAR EXTENDED BASIC

The programming language BASIC is an integral part of North Star products, although there are many uses for these products which may not involve BASIC. North Star Extended BASIC will operate on both 8080 and Z-80 computer systems. Three versions of BASIC are currently available in conjunction with the hardware floating point board and/or MICRO-DISK SYSTEM: Version 5-FPB, Version 6, and Version 6-FPB. North Star Extended BASIC is not available as a separate product, but is only sold with North Star hardware products. Object code only is supplied.

Version 5-FPB is an extended version of BASIC which includes the following extended features:

- Strings (no limit on string length)
- String operators (concatenation, relationals, and substrings)
- Multiple dimensioned arrays
- Multiple-lined function definitions with multiple arguments
- Formatted output facility
- Machine language CALL and memory read and write
- Logical operators (AND, OR and NOT)
- IF-THEN-ELSE and ON-GOTO statements
- Program RENUMBER capability

BASIC commands:

|      |      |      |       |
|------|------|------|-------|
| RUN  | LIST | SCR  | REN   |
| CONT | LINE | NULL | CLEAR |

BASIC statements:

|         |       |        |      |
|---------|-------|--------|------|
| LET     | GOTO  | PRINT  | DEF  |
| FOR     | NEXT  | INPUT  | EXIT |
| STOP    | REM   | READ   | DATA |
| RESTORE | GOSUB | RETURN | FILL |
| DEFFN   | ENDFN | OUT    | END  |
| IF      | ON    |        |      |

Built-in functions:

|       |       |      |      |
|-------|-------|------|------|
| ABS   | SGN   | SIN  | COS  |
| RND   | SQRT  | LOG  | EXP  |
| FREE  | INT   | LEN  | VAL  |
| STR\$ | ASC   | CALL | EXAM |
| IN    | CHR\$ |      |      |

Version 5-FPB is supplied on paper tape with the hardware floating point board. It can be executed from an 8K read-only-memory. The origin is set at 2000 hex, and the precision is set at 8 digits.

Version 6 includes all the features of Version 5. Additionally, it includes commands to save and load programs using the North Star MICRO-DISK SYSTEM. Version 6 also includes the ability for BASIC programs to perform both sequential and random-access disk file processing. Both strings and numeric values may be stored in BASIC data files. A convenient line editor for modifying BASIC programs is also included. Version 6-FPB is the same as Version 6 except that it requires the FPB to operate. Version 6-FPB will execute up to 10 times faster than Version 6, depending on the amount of floating point computation in a program. Version 6 and Version 6-FPB require less than 10K of RAM to execute. If an FPB is ordered for use with a MICRO-DISK SYSTEM, then specify that Version 6-FPB on diskette is desired rather than Version 5-FPB on paper tape. Version 6 and Version 6-FPB have their origin at 2A00 and do arithmetic with 8-digit precision in the standard versions. Non-standard origins and precisions (up to 14 digits) may be ordered as added options (MDS-SPEC).

### NORTH STAR MICRO-DISK SYSTEM



The North Star MICRO-DISK SYSTEM is a complete floppy disk system for 8080 and Z-80 computer systems which follow the S-100 (ALTAIR, IMSAI, etc.) buss conventions. For a complete, disk-oriented computer system which can execute BASIC, all that is needed is the computer, 16K bytes of memory (RAM), an I/O terminal and the North Star MICRO-DISK SYSTEM. Just turn on the power and begin executing our Version 6 Extended Disk BASIC within a few seconds.

**The Drive:** At the heart of the North Star MICRO-DISK SYSTEM is the Shugart SA-400 minifloppy™ disk drive. Shugart has been established as the leader in floppy disk drive manufacturing by delivering over 60,000 floppies. The minifloppy is a compact, economical version of their standard drive. Hard sectored for 256 byte records, each 5" diameter diskette can store 89.6K bytes of information, formatted as 35 tracks with 10 sectors per track. Track-to-track access is 40ms, and latency is 100ms. The data transfer rate is 125K bits per second. These figures mean that 8K of data can be transferred in less than one second, and that a single diskette can hold over 50 typical BASIC programs. The drive comes assembled and tested, even in systems purchased in kit form.

**The Controller:** The North Star MICRO-DISK Controller interfaces the disk drive to the computer system. The control-



ler is a single PC board that plugs directly into the S-100 buss. Commands and data are transferred from software by the technique of memory-mapped I/O (no I/O ports or DMA are used). Up to three drives can be controlled, with or without interrupts. The controller allows transfer of between one and ten 256-byte blocks of data between the diskette and RAM in a single revolution. Cyclic redundancy error checking is done for each data block read from disk. The controller automatically turns the drives on and off to minimize head and diskette wear. The controller is made from Schottky and low-power Schottky small and medium scale integrated circuits and includes its own crystal controlled clock. Sockets are supplied for all integrated circuits.



**Bootstrap PROM:** The controller includes on-board PROM memory, pre-programmed to permit power-on start-up of the computer. The PROM program loads the Disk Operating System (DOS) from drive #1 into memory and then branches to the loaded DOS. Much of the low-level

software for the DOS is on the PROM. The on-board PROM and the memory-mapped I/O together use 1K of the computer address space, starting at E800 hex in the standard version. Non-standard versions with different origins are available as an extra cost option (MDS-SPEC).

**Disk Operating System:** The North Star Disk Operating System (DOS) is supplied on diskette. The DOS provides access to disk files either through *COMMANDS* typed from the computer terminal, or through *SUBROUTINES* called by software. The operations provided implement a named file system (i.e., all files on the disk(s) can be referenced by use of symbolic names of up to 8 characters). The DOS commands include:

|    |                      |    |                    |
|----|----------------------|----|--------------------|
| CR | create a file        | DE | delete a file      |
| LI | list file directory  | TY | set file type      |
| LF | load file to RAM     | SF | save file from RAM |
| CF | copy file to file    | GO | load and execute   |
| IN | initial diskette     | DT | disk test          |
| CD | copy entire diskette | CO | compact file space |
| RD | read from disk       | WR | write to disk      |
| JP | jump to RAM address  |    |                    |

The DOS has been designed to allow convenient modification for interfacing to any computer I/O terminal configuration. 256 bytes of space have been reserved in the DOS for your I/O routines, and step-by-step instructions are included describing how to make your I/O routines a permanent part of the DOS. The North Star DOS resides in 2.5K of memory, and has its origin at 2000 hex in the standard version. Non-standard origins of the DOS may be ordered as an extra cost option (MDS-SPEC).

**Extended Disk BASIC:** North Star Extended Disk BASIC is an integral part of the MICRO-DISK SYSTEM, and is supplied on diskette. See the description above for Version 6 BASIC. Commands exist to load and save BASIC programs from disk, and BASIC programs can process disk files in either sequential or random order.

**Power:** The power requirement for the controller board is .7 amps at 5V. The power requirements of a single drive are as follows:

5V - .5AMP (typ), .7AMP (max)

12V - .9AMP (motor on), 1.6AMP (motor startup)

Each drive is supplied with a power regulation PC card that mounts to the back of the drive. The drive can be powered by tapping unregulated power from the computer. In typical configurations, the following computers provide sufficient power

for at least one drive: IMSAI 8080, ALTAIR 8800B, and POLY88. Alternatively, the North Star MICRO-DISK Power Supply (MDS-PS) is available as an added option. The MDS-PS uses standard 115VAC power. One MDS-PS will provide power for 1 drive.

**Mounting:** For the controller, a single slot on the computer backplane is required. The drive itself measures 5.75" by 3.25" by 8" and may be mounted inside the computer system, if sufficient room exists. If external mounting is preferred, the North Star MICRO-DISK Cabinet (MDS-CAB) is available as an added option. Each cabinet will hold one disk drive and one power supply.

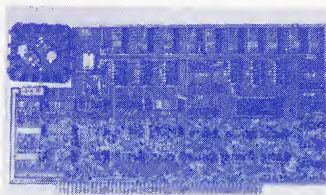
**Included in the MICRO-DISK SYSTEM (MDS-A-KIT and MDS-A-ASM):**

- The North Star Controller
- The SA-400 drive (assembled and tested)
- Power regulation PC card with components
- Cabling and connectors
- Two diskettes (one pre-loaded with DOS and BASIC software)
- Complete hardware and software documentation

**Included in the ADDITIONAL DRIVE (MDS-DRIVE-KIT and MDS-DRIVE-ASM):**

- The SA-400 drive (assembled and tested)
- Power regulation PC card with components
- Additional cable connector

## HARDWARE FLOATING POINT BOARD



The North Star FPB floating point unit is a single PC board which performs decimal floating point add, subtract, multiply and divide with up to 14 digits of precision. The Model-A FPB plugs into the S-100 (ALTAIR, IMSAI, etc.)

buss, and the Model-B FPB plugs into the Intel SBC and MDS busses. The FPB will perform floating point operations approximately 50 times faster than the best 8080 software or firmware. A typical 10 digit multiplication, when performed by the FPB, computes in 111 microseconds. The time is 5.5 milliseconds when the same operation is performed by the best 8080 software.

The FPB floating point unit is implemented using Schottky and low-power Schottky small and medium scale TTL integrated circuits. Sockets are provided for all integrated circuits. The FPB implements a high speed microprocessor specially designed to perform fast floating point operations. The FPB microprocessor waits for a command from the 8080 or Z-80 program to start a floating point calculation. The command indicates the operation desired, and the precision. Then the FPB microprocessor receives the floating point values one byte (two digits) at a time, computes the result, and returns the result along with a status byte indicating any overflow or underflow conditions. The method of communication between the computer and the FPB permits values to be passed at the rate of 6 microseconds per byte using an 8080A, and proportionately faster if a higher speed computer is used.

The FPB is delivered with a version of North Star BASIC. See above for details.

The power requirements for the FPB are as follows:

Model-A: 8V (unregulated) at 1.7A

Model B: 5V (regulated) at 1.7A

## FPB EXECUTION TIMES 1, 2, 3

| PRECISION DIGITS: |         | 2  | 4   | 6   | 8   | 10  | 12  | 14  |
|-------------------|---------|----|-----|-----|-----|-----|-----|-----|
| ADD               | best    | 1  | 1   | 1   | 1   | 1   | 1   | 1   |
|                   | typical | 8  | 8   | 9   | 9   | 10  | 10  | 11  |
|                   | worst   | 10 | 10  | 10  | 11  | 11  | 12  | 12  |
| SUBTRACT          | best    | 4  | 4   | 4   | 4   | 4   | 4   | 4   |
|                   | typical | 8  | 8   | 9   | 9   | 10  | 10  | 11  |
|                   | worst   | 15 | 16  | 17  | 18  | 19  | 20  | 21  |
| MULTIPLY          | best    | 5  | 5   | 5   | 5   | 5   | 5   | 5   |
|                   | typical | 18 | 34  | 55  | 80  | 111 | 146 | 186 |
|                   | worst   | 51 | 125 | 228 | 382 | 527 | 720 | 933 |
| DIVIDE            | best    | 7  | 7   | 7   | 7   | 7   | 7   | 7   |
|                   | typical | 39 | 70  | 109 | 156 | 211 | 274 | 370 |
|                   | worst   | 62 | 139 | 229 | 340 | 470 | 621 | 779 |

1. Times given in microseconds

2. Execution times are a function of the input values

3. Times listed do not include transmission of input values and result

Floating point number representation:

Byte 1: bit 7=sign (1=negative number, 0=positive number)  
 bits 6-0 = exponent in excess 64 binary representation  
 bits 7-0 = zero represents the zero value

Byte 2: bits 3-0 = least significant digit of value in BCD coding  
 bits 7-4 = next least significant digit of value

Byte N: bits 7-4 = most significant digit of value in BCD coding  
 bits 3-0 = next most significant digit of value

All values are normalized.

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2465 FOURTH STREET, BERKELEY, CA 94710

TEL: 415-549-0858